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Possibilities of enhance oil recovery in tight carbonate reservoirs

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Over the years, CO₂ injection has become a leading EOR method, the method can significantly increase the oil recovery while at the same time reduces CO₂ emission. CO₂ is considered as an excellent fluid for enhanced oil recovery due to its favourable interaction with the reservoir oil. the oil recovery can be enhanced through miscible or immiscible displacement, interfacial tension reduction, light-hydrocarbons extraction, oil swelling, oil viscosity reduction. However, the main disadvantage is the relative low density and viscosity of CO₂ compared to reservoir oil which usually results in gravity tonguing and viscous fingering and poor sweep efficiency, another schemes of injection can be used to eliminate these problems, are alternating (WAG) or simultaneous injection of CO₂ and water (SWAG) instead of continuous CO₂ flood.

An alternative, more efficient CO₂ injection scheme is carbonated (CO₂ -enriched) water injection. A fluid consists of CO₂ dissolved in water will be flooded into the reservoir. In this scheme a larger amount of CO₂ can be used and dissolved in water without the

risk of leakage of CO₂ through cap rock in comparison to the conventional schemes. The flooded fluid will have an acidic effect on the formation, dissolving tight pores thus, increasing the permeability. Also, it results in significant oil swelling, reduces the gravity segregation and gas fingering and improves the sweep efficiency, hence a higher incremental oil recovery is obtained.

The main objective of this research/study is to experimentally examine the oil recovery performance of carbonated water under various operating conditions. First, several carbonate reservoir rock samples will be characterized in terms of pore volume, porosity and grain density by saturating the samples with formation water. Second, the initial liquid permeability for the samples will be measured. Third, preparing the carbonated water and measuring its properties. Lastly, flooding the samples with carbonated water at various flow rate and measuring liquid permeability at each rate to verify the best flow rate.

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